NON SURGICAL MANAGEMENT OF ERECTILE DYSFUNCTION

Essay

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INTRODUCTION

Normal sexual function is a biopsychosocial process and penile erection is a neuromuscular event modulated by psyche and hormones [(1)].

Erectile dysfunction (ED) is defined as the inability to obtain and/or maintain penile erection sufficient for satisfactory sexual performance [(2)].

Erectile dysfunction (ED) is a prevalent male health problem of global dimensions. Approximately 150 million men worldwide have some degree of ED, and this value is projected to more than double by the year 2025 [(3)].According to epidemiologic studies focusing on the United States, the prevalence of ED is approximately 30 million cases, which is projected to increase by nearly 10 million by 2025 [(3)].

Little is known about the natural history of erectile dysfunction. It is clearly a symptom of many clinical conditions and certain risk factors have been defined, some of which may be amenable to prevention strategies [(4)].

ED can be ascribed to vasculogenic, neurogenic, psychogenic, structural (anatomical), and/or endocrinologic factors [(5)].

Many changes contribute to aging erectile dysfunction as Low testosterone level, atherosclerosis, low penile oxygen tension and changes of the ratio of penile collagen [(6)].

A lot of treatment options are currently available, however the treatment of erectile dysfunction was revolutionalized by introduction of sildnafil therapy [(7)].Non surgical treatment options include psychotherapy, change of offending medications, and hormonal therapy, oral therapy, vacuum constriction device, transurethral therapy and intracavernous injection [(8)].

AIM OF THE WORK:

To shed light on the etiology, pathophysiology, recent diagnostic procedures of erectile dysfunction and also to evaluate the recent advances in non surgical management of erectile dysfunction.

SURGICAL ANATOMY OF THE PENIS

Structure

The human penis is a unique structure composed of multiple fascial layers which surround the three cylinders of erectile sinusoids [9].

The penis can be divided into three parts: the root, the body, and the glans [10]. The root, or penile bulb, is located within the superficial perineal pouch, the body is formed by the three spongy erectile anatomic entities: two corpora cavernosa and one corpus spongiosum, and The glans is the distal end of the corpus spongiosum [10].

The root of the penis is located in the superficial perineal pouch, and consists of the crura, bulb, ischiocavernosus and bulbospongiosus muscles (Fig. 1). [11].

The crura and bulb of the penis contain masses of erectile tissue. Each crus is attached to the inferior part of the internal surface of the corresponding ischial ramus, anterior to the ischial tuberosity [11].

The corpus spongiosum dilates as the bulb of the penis and is fixed to the center of the perineal membrane [13].

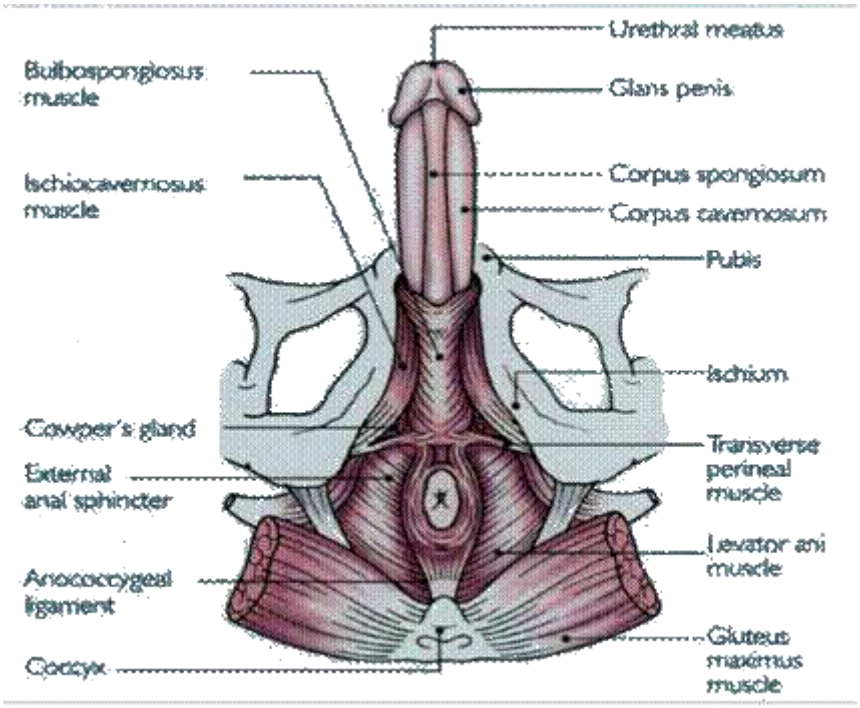

Figure (1): Muscles of the pelvic floor surround and support the erectile bodies and corpus spongiosum [(12)].

The key structures mediating penile erection are the paired corpora cavernosa or 'erectile bodies', These cylindrical structures form the bulk of the penis and fill with arterial blood under pressure at the time of erection [(12)].The paired corpora cavernosa attach to the inferior ischiopubic rami and perineal membrane and are surrounded by the ischiocavernosus muscles [(13)].

The corpora cavernosa join beneath the pubis (penile hilum) to form the major portion of the body of the penis and they are separated by a septum that becomes pectiniform

distally, so that their vascular spaces freely communicate [13]. Each corpus cavernosum has a thick fibrous sheath, the so-called tunica albuginea, which surrounds the erectile tissue, made up of multiple lacunar spaces that are inter-connected and lined by vascular endothelium (Figure 2). [12]. The trabeculae constitute the walls of these spaces, and comprise smooth muscle and a fibroelastic framework of collagen in almost equal quantities [12].

Distal to the bulb, the corpus spongiosum tapers and runs on the underside (ventrum) of the corpora cavernosa and then expands to cap them as the glans penis [11]. The spongiosum is traversed throughout its length by the anterior urethra, which begins at the perineal membrane, it is dilated in its bulbar and glanular segments (fossa navicularis) and narrowest at the external meatus [11].

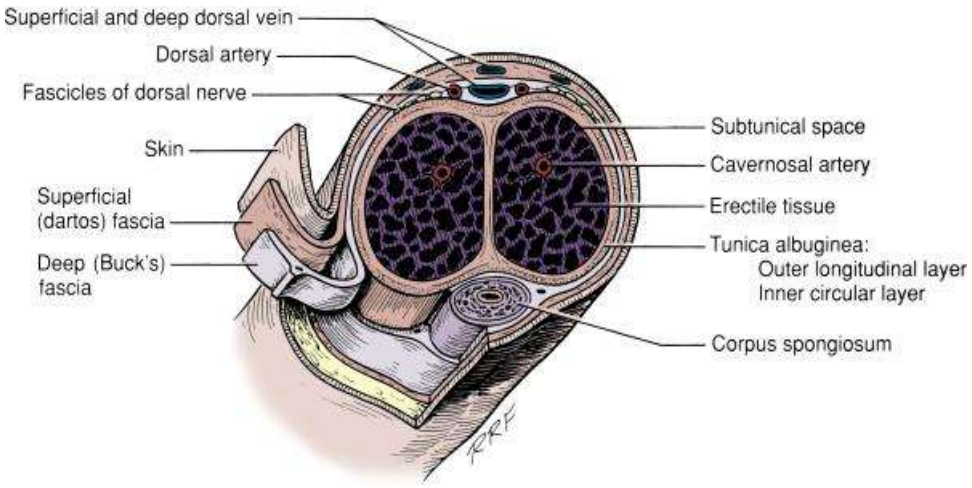

Figure (2)*:* Cross section of the penis, demonstrating the relationship between the corporal bodies, penile fascia, vessels, and nerves [13].

Skin of the penis

The skin overlying the penis is exceptionally mobile and expandable to accommodate the considerable increase in girth and length that occurs during erection [12]. It is extremely thin, dark color, and adipose tissue completely absent [14].

The skin of the penile shaft is highly elastic and without appendages (hair or glandular elements), except for the smegma-producing glands at the base of the corona [13]. At the glans it becomes folded upon itself to form the prepuce. Immediately behind the external urethral orifice it forms a small secondary reduplication, attached along the bottom of a depressed median raphe, which extends from the meatus to the neck; this fold is frenulum of the prepuce [14]. Its blood supply is independent of the erectile bodies and is derived from the external pudendal branches of the femoral vessels[13].

Fascia and Ligaments of the penis

Subcutaneous fascia directly continuous with that of the scrotum, and, like it, contains a dartos tunic with its layer of scattered smooth muscle cells [14].

Buck's fascia surrounds both cavernosal bodies dorsally and splits to surround the spongiosum ventrally [13]. In the perineum, Buck's fascia fuses with the tunica albuginea deep to the muscles of the erectile bodies,and distally, it fuses with the base of the glans at the corona [13].

Ligaments of the penis

The pendulous portion of the penis is supported by the suspensory ligament, a fibrous condensation which supports and stabilizes the erect penis [14].It is a condensation of the deep fascia that arises from the anterior surface of the pubic symphysis and splits to form a sling that is attached to the deep fascia of the penis at the junction of its root and body [11].

The fundiform ligament of the penis is a band of the subcutaneous tissue that descends in the midline from the linea alba superior to the pubic symphysis. It passes inferiorly and splits to surround the penis and then unites and blends with the dartos fascia forming the scrotal septum [11].

Vasculature of Penis

The arterial blood supply of the penis is formed by a superficial and a deep system.The external pudendal artery is responsible for the formation of the superficial system; the internal pudendal artery provides the deep system [10].

Superficial and deep branches of the external pudendal arteries supply the penile skin, anastomosing with branches of the internal pudendal arteries [11].

The internal pudendal arteries, right and left, give origin to the penile artery. The penile artery gives three or four bilateral branches to the penis: the bulbourethral artery (the

artery to the bulb and the urethral artery), the deep artery (central or cavernous), and the dorsal artery [10].

The dorsal artery of the penis passes between the crus penis and the pubis to reach the dorsal surface of the corporal bodies, running between the dorsal vein and the dorsal penile nerve and with them attaches to the underside of Bucks fascia [15]. As it courses to the glans, it gives off cavernous branches and circumferential branches to the spongiosum and urethra [15].

The deep (cavernous) arteries run through the center of the corpora cavernosa near the septum and give off the corkscrew-shaped helicine arteries, whose end branches open either directly into the sinusoidal spaces or into subalbugineal venules via shunts [16].

Arteries of the bulb of the penis supply the posterior (bulbous) part of the corpus spongiosum and the bulbourethral gland, They give off numerous branches (helicine arteries of penis) that open directly into the cavernous spaces[11].

Venous Drainage

At the base of the glans, several venous channels coalesce to form the dorsal vein of the penis, which runs in a groove between the corporal bodies and drains into the preprostatic plexus [13].

Blood from the cavernous spaces of the corpora is drained by a venous plexus that becomes the deep dorsal vein of the penis in the deep fascia which passes deep between the laminae of the suspensory ligament of the penis, anterior to the perineal membrane, to enter the prostatic venous plexus [11]. Intermediary venules form from the cavernous sinuses to drain into a subtunical capillary plexus. These plexuses give rise to emissary veins, which commonly follow an oblique path between the layers of the tunica and drain into the circumflex veins dorsolaterally [15]. Emissary veins in the proximal third of the penis join on the dorsomedial surface of the cavernous bodies to form two to five cavernous veins [15].

Lymphatics of the penis

The lymphatics of the penile skin drain into the superficial inguinal and subinguinal lymph nodes, the lymphatics of the glans penis empty into the subinguinal and external iliac lymph nodes. The deep lymphatics drain into hypogastric anad common iliac lymph nodes [16].

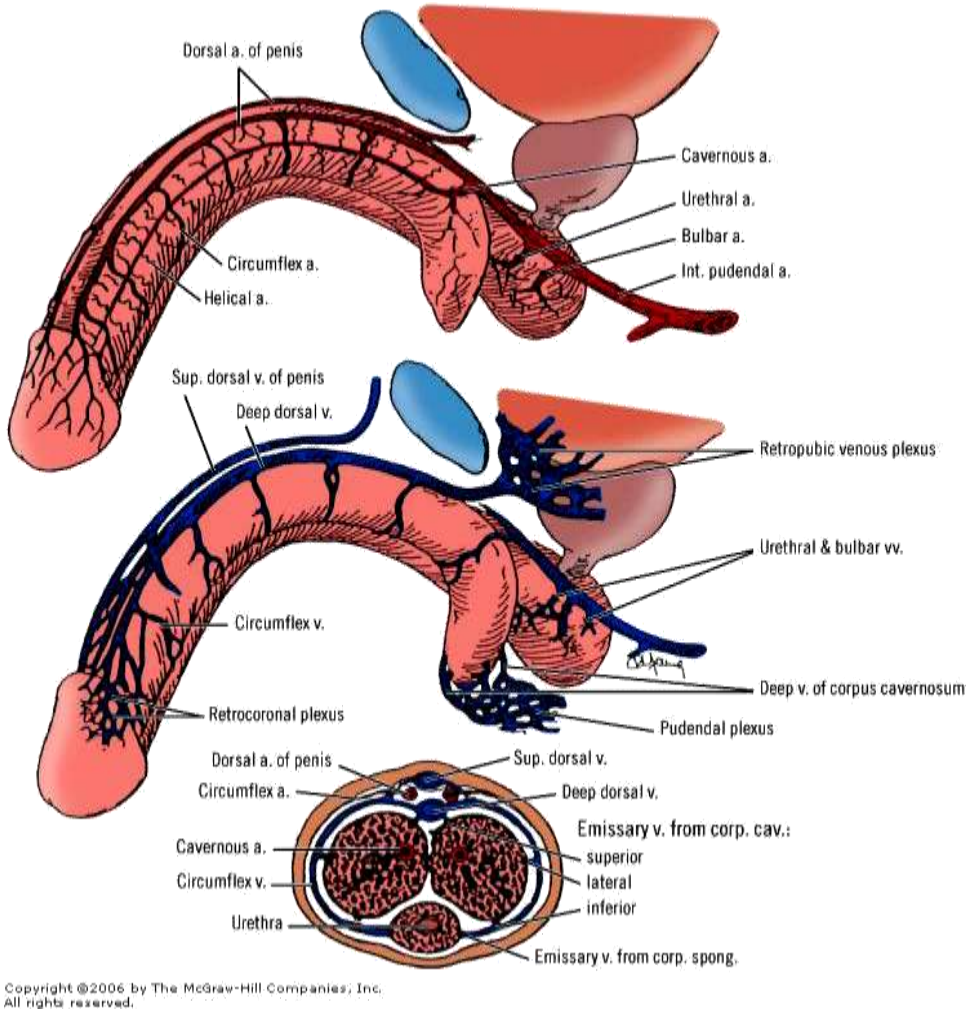

Fig. (3): Vasculature of penis [10].

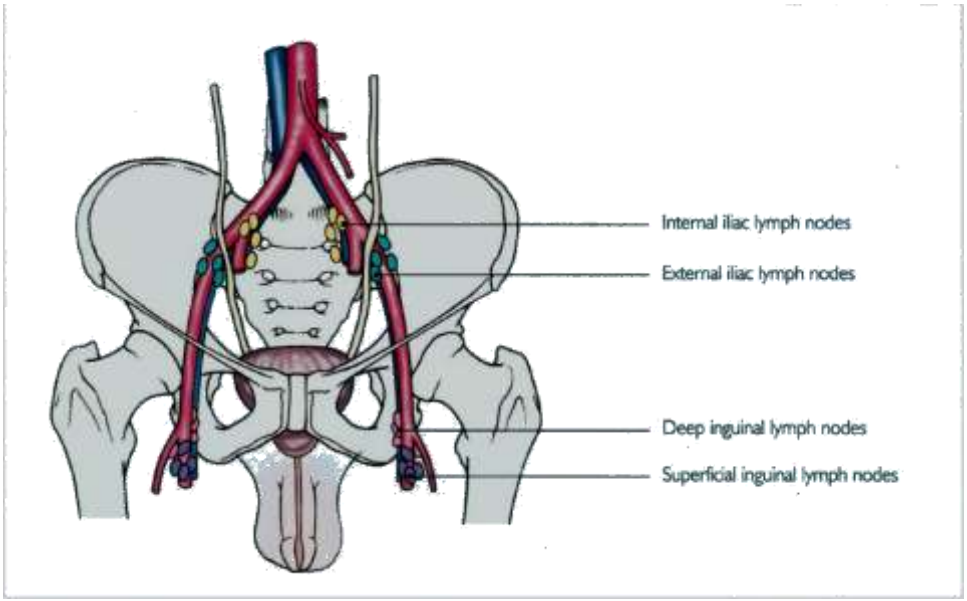

Fig. 4 Lymphatics of the penis [(12)].

Innervation of the penis

The penis is richly innervated by autonomic (sympathetic, parasympathetic) and somatic (sensory and motor) nerves.

The sympathetic pathway originates from the 11 th thorathic to the second lumbar spinal segments and passes via the rami to the sympathetic chain ganglia (fig. 5), some fibers then travel via the lumber splanchnic nerves to the inferior mesenteric and superior hypogastric plexuses, from which fibers travel in the hypogastric nerves to the pelvic plexus [(19)].

In man, the T 10-12 segments are most often the origin of sympathetic fibers, and the chain ganglia cells projecting to the penis are located in the sacral and caudal ganglia [19].

Parasympathetic pathway originates in the intermediolateral aspect of the sacral cord (S_2–S_4) traveling in the pelvic nerve (Nervi Erigentes) to supply a vasodilating innervation to the corporeal bodies. After the parasympathetic nerve fibers exit the spinal cord, they run through the retroperitoneal space in the lateral aspect of the rectum and bladder, and then pass inferiorly and laterally toward the prostate and urogenital diaphragm [18].

The cavernous nerve originates from the prostatic plexus and supplies the corpus cavernosum, occasionally, it bifurcates,one branch is responsible for the erectile tissue of the corpus spongiosum and the penile urethra and the other branch is responsible for the erectile tissue of the corpora cavernosa [10].

The cavernous nerve enters the corporeal body alongside the cavernous artery at the crura of the corpora as preganglionic nerve fibers. The postganglionic nerve fiber segments terminate either on the vascular smooth muscle of the corporeal arterioles or the nonvascular smooth muscle of trabecular tissue surrounding the corporeal lacunae [18].

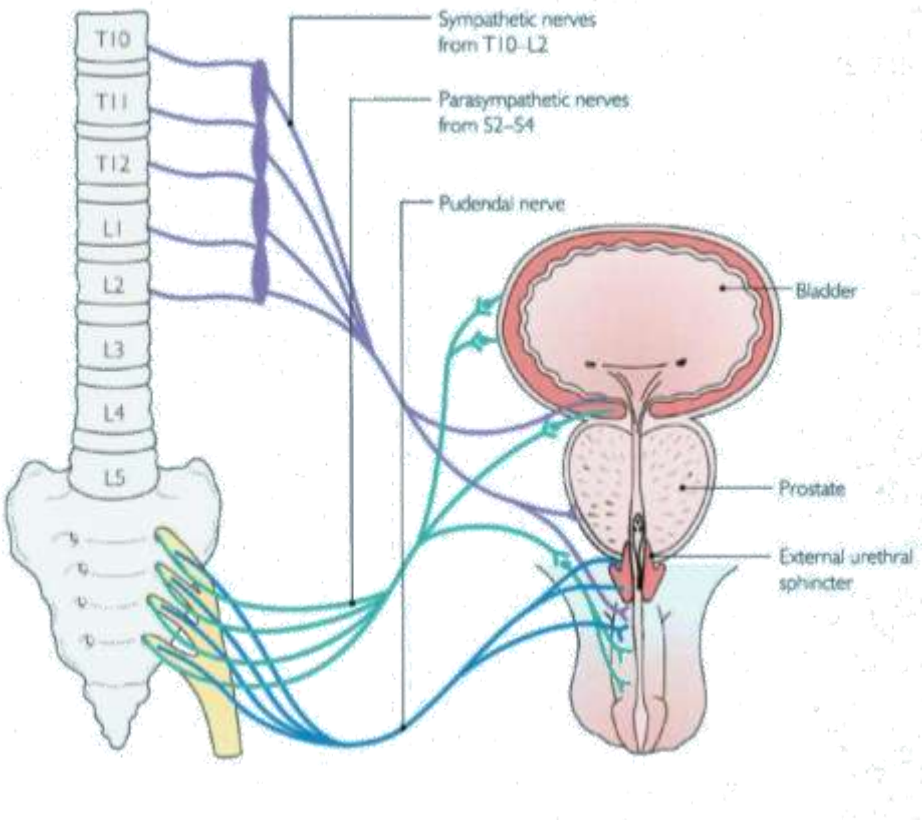

Fig. 5 Innervation of the penis; [12].

Somatic: The penis is supplied with a variety of sensory nerve endings, especially the glans penis. Branches of the ilioinguinal nerve supply the skin at the root of the penis [11].

The nerve fibers from the receptors in penile skin, glans, urethra, and within the corpus cavernosum converge to form bundles of the dorsal nerve of the penis, which join other nerves to become the pudendal nerve [19].

The sensory fibers enter the dorsal gray of the cord at cord levels S2-S4. Likewise, the motor supply to the ischiocavernosus and bulbospongiosus muscles is supplied by motor fibers from the ventral gray area at the same cord levels **(10)**.